

**GENDER AND COMPUTER USE IN AN  
ACADEMIC INSTITUTION:  
REPORT FROM A LONGITUDINAL STUDY**

**ANANDA MITRA  
STEFNE LENZMEIER  
TIMOTHY STEFFENSMEIER  
RACHEL AVON  
NANCY QU  
MIKE HAZEN**  
*Wake Forest University*

**ABSTRACT**

This article explores the nature of the relationships between gender, categories of computer use, and attitudes toward computers in a computer enriched environment where all students were provided with network access and laptop computers over a four-year period. The results indicate that women were less positive about computers than men, and the use level of computers by women were less frequent than for men. This change in the relationship is a throwback to the earlier days of computing when research had indicated that men were more positively disposed toward computers than women.

**INTRODUCTION**

During the past two decades educational institutions, according to technology proponents, have been transformed by the “digital revolution” as the computer is considered one of the most influential pedagogical tools [1]. The computer’s impact on education generally has been related to the degree that it can impact learning. The inherent difficulty with this perspective is determining how to assess such a complex concept, learning. This difficulty has led to a tendency where researchers attempt to find “surrogate” measures of learning, a principal one being

individual's attitude toward the use of computers in teaching with hosts of attitude scales being developed to measure attitude toward technology [2-7].

While attitude has been measured in many different ways and conceptual links between attitudes and learning have been suggested, the fundamental definition of "computing" has remained somewhat fuzzy too. In most cases, the literature does not acknowledge the variations in the term "computing" [8]. Computing, an umbrella term for computer use, was an adequate label while these machines predominately were used for mathematical and word processing tasks, but today computers are used in various facets of life. Some recognition of the difficulty of using the term "computing" is seen in researchers who choose to use "computer use" instead of "computing" when referring to the way in which technology is being mobilized in pedagogy. This shift in language helps to think of the transformation of the computer from machines that strictly are used to compute to those that enable communication. Consequently, researchers were able to consider how the various uses of computers affect attitude toward computers [9, 10]. These researchers began indicating how various ways of using the computer affect a student's attitude toward the machine. While this was a welcome advance in the thinking of the role of computers in education, there was still inadequate discrimination in thinking of what is meant by "computer use" and the various possible uses were not completely defined or categorized.

Mitra and Hullet honed in on the variation of computer use among college students and advanced the finding that different categories of use are related to different categories of attitudes [11]. One's attitude may vary when they are using a computer to communicate compared to using it for statistical analysis. With the emergence of laptop campuses—a college or university that requires all students to own and operate a laptop computer—the term "computer use" transforms further. These new environments, where students are submersed in the ubiquitous use of computers, are different from traditional campuses where computer use is dependent on the availability of computer labs. Laptop campuses, according to Mitra and Steffensmeier are computer-enriched environments [12]. Their research reveals that these "enriched environments" create a more positive shift in student's attitudes toward computing than the traditional campuses.<sup>1</sup>

As demonstrated in this brief review, there has been a fair amount of confusion about the related issues of "learning," "attitudes," and "computer use." However,

<sup>1</sup>It should be noted that the term "enrichment" is a politically, sociologically and ideologically biased term that projects an assumption that introduction of computers in an educational environment can necessarily result in a positive outcome. That is not the way in which term should be interpreted in the current context. Indeed, the term "enrichment" here is used in a more technological sense where the engineering and technology of computing has become more elaborate, robust and often ubiquitous and thus has increased the depth and density of the technological availability of computers in an environment. It is analogous to enriching a chemical solution by thickening it with increasing addition of a soluble material in a solvent. Using that analogy enrichment can ultimately result in saturation and precipitation neither of which might be necessarily a positive outcome.

one factor that has remained relatively constant as an independent variable determining the levels of learning, attitude and use is the gender of the users. For instance, much research focuses on the difference in attitude toward computers between genders. Some of the earliest studies reveal that females harbor more negative views toward computers than males [13-15]. The three primary components of computer attitudes: Computer Anxiety, computer confidence, and computer liking are used to determine negative and positive attitudes amongst the two genders [16].

Predominately, early studies reveal that males are less anxious, more confident, and like using computers more than females. Despite these findings researchers also conclude the opposite; gender does not directly impact a student's attitude toward computers. These findings are a result of taking into account the variable "computer experience." Chen concludes that males in general show more positive attitudes of interest and confidence with computers than do females [13]. However, when the amount of computer experience is controlled, males and females respond with similar levels of interest. Hunt and Bohlin reported on a research study designed to measure the entry attitudes of students enrolling in educational computing classes and found that previous experiences were the best predictors of student attitudes [17]. Males indicated having more experience with programming and recreational uses of computers but gender did not significantly correlate with any of the attitude variables. Levin and Gordon confirm the impact of computer experience on attitudes and add that having an actual computer in the home has a greater affect on attitude toward computers than does gender [18].

The contradiction between results from the various studies may suggest that the current methodologies are inadequate for measuring gender differences. Kay suggests that most studies use a quantitative, construct-testing, cross-sectional approach to assess general behaviors [19]. He argues that to fully understand whether gender differences exist in human-computer interaction, a qualitative, contextual, developmental approach should be employed to examine specific cognitive tasks. He stresses that without this comprehensive understanding, we will continue to identify only pieces of a very complex puzzle. In addition, Arenz and Lee found that differences in role models, attitudes, interest, and computer use exist between gender as well as within gender [20]. This may suggest that stereotypes still empower the notion that computers are still of male domain. In addition to commenting on the research methods and the slippery relation between gender and technology, these researchers, in their critique, are also implicitly pointing toward the confusion caused by considering computer use as a unidimensional construct. Thus, the confusion inherent in defining learning, attitudes, and computer use impact the way in which the relations between these constructs and gender can be understood.

During the 1990s, computers became more popular in homes and in schools, largely because of the ability to be used as a communicative medium. The use of electronic mail and Internet spread rapidly within business and educational

environments; simultaneously, the majority of research began charting a shift in attitudes toward computers amongst the genders. Almost overwhelmingly, studies conclude that there are no significant difference in attitude toward computers between women and men [21-23]. Todman and Monaghan confirm this hypothesis as their study reveals that age of initial introduction to computers, qualitative aspects of early computer experience, level of computer anxiety, and current and anticipated future frequency of use of computers all relate to a student's attitude toward computers; gender was the only variable found to lack a significant direct or indirect effect on a student's attitude [24].

Only when the trend that males and females exhibit similar attitudes toward computers was recognized that researchers began asking if these results were the same for all types of computer use. C. R. Scott and Rockwell explored the role of computer anxiety, communication apprehension, and writing apprehension in predicting future use of computers as communication tools [25]. They found that past computer use appears to be a strong predictor of future use; however, gender differences are rare: male respondents reported a greater likelihood of joining online services and playing video games. These two instances were exceptions; there were no other differences between the genders regarding likelihood to use new (or more traditional) technologies. Rockwell's research points to a fundamental distinction not made in previous research—the difference in types of computer use by gender. More importantly, this information can be used to determine if there is a difference in attitude toward computers because of specific use patterns between genders.

As this review suggests there is some confusion about the relationship between gender and contemporary attitudes and use of computers. In the educational setting, this confusion leads to doubts about the way in which differences in learning in a computer-enriched environment could be related to gender. We argue that there are two areas that need further exploration: 1) there is an alteration in the relation between gender and different kinds of the computer use as computer enriched environments are emerging, and 2) the emergent environments and the cultures that these environments spawn can lead to new areas of differences between genders when computers are considered as the key technology of the new academic environment. These considerations drive us to advance one broad research question: What are the relationships between gender, categories of computer use, and attitudes toward computers in the emergent computer-enriched environments of academic institutions?

## METHODOLOGY AND DATA

Given the breadth of the question, we have utilized the data from an ongoing longitudinal assessment of the impact of computerization at a small liberal arts institution that initiated a process of computer enrichment by entering into collaboration with a major computer industry leader. Through the terms of the

collaboration between the University and the industry, the University was able to upgrade and overhaul its internal network system with the ability to provide ubiquitous access to a LAN as well as providing every student in the University with a laptop computer. The entire faculty was also provided with laptop computers. This process started with the incoming students of 1996 and by the year 2000, all the students in the University would have their own laptop computers. The phasing in of the computer ownership resulted in a transitional period where some students had laptop computers while others did not. This unique process provided the opportunity to conduct a longitudinal study of the impact of this computer enrichment.

The longitudinal study was composed of three different components. This article utilizes information from all the components. Each of the components represented somewhat different methodological approaches as well as different but interrelated goals. First, there was a component that included a survey design to collect self-response data from a sample of students and faculty at the University. The surveys continue on an annual basis and use questionnaires that were developed after extensive focus group interviews with students and faculties. The survey instruments represent moderately reliable items and include items about computer use, attitudes toward computers and general technographic and demographic information [8, 12, 26-28]. The second component of the study included a qualitative methodology that was geared toward analyzing the cultural changes unfolding at the University as the computer enrichment progressed [29]. In this article, the qualitative approach is used to conduct a brief content analysis of a series of news stories and editorials that appeared in the campus newspaper to discuss the implications of the computer-enrichment process. The third component of the study involved a panel design to track the changes in computer use and attitudes among students. The panel approach was conceived with a more specific focus on relational dynamics resulting from computer use rather than simple computer use. This difference, coupled with the fact that the panel approach enabled us to track specific users over time and thus gain the methodological advantages of doing so, makes the panel a beneficial complement to the general survey component. The panel was first formed by having the admissions office make a random sample of one-third of incoming students (the Class of 2000), who were asked in a letter mailed to them at the end of the summer if they would be willing to participate in a four-year study of their use of the laptop computer. Thereafter, a stratified random sample of 150 male and 150 female students was used, with the same initial letter and consent form sent at the end of the summer and follow-up materials once they arrived on campus. Each fall, the survey was administered, which was comprised of questions about various forms of communication (CMC, face-to-face, and telephone communication), frequency of use, groups or individuals with whom one communicates, preferences for form with respect to task-related versus relational communication, computer apprehension, and an unwillingness to communicate measure.

Thus, the data used in this analysis includes the findings from the survey component as well as the information gathered in the content analysis and the analysis of the data gathered in the panel component of the study. To keep the information organized around a central point, the analysis of the survey data is used as the focus for answering the research question raised in this article. The data from the other components is used in supporting or challenging the survey data. In the results section of this article, we therefore focus primarily on the results of the longitudinal survey design and later in the discussion section we bring in the information from the other two components of the study.

## RESULTS

In discussing the results of the study, it is important to first recognize that there are three key independent factors that are critical to the understanding of the question raised earlier in the discussion. First, the factor of computer enrichment is critical. The fact that there has been an explosion in the availability of computers in institutions that have chosen to become “wired” has led to the development of a new academic environment where the expectations of students, teachers, the administration and the employers of graduating students is expected to change. However, such altering expectations might not always remain congruent with each other and therefore lead to different kinds of attitudes and levels of use that can in turn be impacted by gender differences. Therefore, the second key factor is indeed gender. There is enough evidence to suggest that women could have a different attitude toward technology than men and such differences can in turn be manifest in the way women express their attitudes toward computers and their level of use of computers in the computer-enriched academic environment. Finally, in this particular study, there is the third factor of time where different student groups experienced different levels of computer enrichment as the University became more computer enriched. For instance, the first year of the computerization process witnessed only a quarter of the students owning their own laptops with a network system that was still fraught with weaknesses. However, within a couple of years half the students had their own laptops, there were fewer institutionally supported public computer laboratories and a robust and reliable network. These changes continued with time and thus students in different school years at different stages of the computer-enrichment process could exhibit different attitudes and levels of use. While this study was able to measure the attitudes and use levels for different genders, in different school years and at different stages of the computer-enrichment process, the question of expectation was far more difficult to tackle. However, the results presented here could perhaps be interpreted to some degree by mobilizing the notion of expectations related to the process of computer enrichment.

Three years of survey results are analyzed in this analysis. The first year was considered the base-line year before the computerization process started. There

were no laptop students in Year 1 and the network was just being developed. In Year 2, the network was largely in place and the first-year students had their own laptops. In Year 3, the network became quite reliable and half the students had their own laptops. A survey design, with data collection at the time of registration, was employed to collect the data. In Year 1 the entire student body was surveyed resulting in an overall response rate of 41.3 percent; in Year 2 a sample of students were surveyed with a response rate of 36.6 percent, and in Year 3 a sample of students were surveyed with a response rate of 21 percent. The survey was administered as a self-response questionnaire (see earlier articles for extended item analysis). The results indicated that the data represented the student population with respect to the primary demographic variables.

The results of the analysis point toward several interrelated findings. The results are presented here in a thematic order to capture the various relationships between gender, use, and attitudes toward computers.

First, the results indicate that before the computer enrichment was initiated on campus, and before the arrival of the laptop students on campus, the men on campus had a significantly more positive attitude toward the use of computers and were also more frequent users of computers. As illustrated in Table 1, men reported that they felt that computers can make the learning process easier, preferred to be in classes where they could use computers, felt more comfortable with computers than women, were less apprehensive about computers than women and were less concerned that computers in teaching would make the teaching process too impersonal. Finally, men reported that computers enabled them to interact more with teachers using computers.

In a similar way, men on campus also reported a more frequent use of computers than women. Computer use was reported as higher by men in all categories of computer use, particularly in the task categories of use ranging from specialized use to the more routine use of the technology. As illustrated in Table 2, this difference disappeared only in the case of the use of electronic mail with teachers.

This trend, continues in the first year of computer enrichment. At this point, a quarter of the students in the University had access to personal laptop computers, the network system, albeit somewhat unreliable, was in place and the computer labs were being phased out. The data suggests that both the legacy and the laptop-program women became less positive toward computers and their use was less than the men (Tables 3 and 4) were.<sup>2</sup> However, at the same time the overall attitude toward computers among both men and women saw an increase in the positive direction (Tables 5 and 6). Furthermore, there were more significant differences in attitude between the legacy women and the legacy men than the laptop women and the laptop men (Tables 7 and 8).

<sup>2</sup>The term "legacy" refers to the students who did not have institutionally provided laptop computers and included the students who were at the university prior to the beginning of the computer initiative in the Fall of 1996.

Table 1. Year 1 Comparison

Attitude Item	All Women	All Men
Increased use of technology makes learning easier	3.39	3.56*
I prefer classes in which I get to use computers	2.72	3.05*
I feel comfortable using the computer	3.38	3.78*
I have a certain apprehension about computer use	3.03	2.55*
Computers in teaching makes the learning process too impersonal	3.25	3.07*
Computer use increases the college work load	3.08	3.06
Computers are effective for communicating with faculty	3.33	3.31
Communicating with professors by e-mail is generally gratifying	3.38	3.32
Computers enable me to interact more with professors	2.94	3.07*

\*Significant difference between means.

Table 2. Year 1 Comparison

Use	All Women	All Men
Spreadsheet	1.50	1.71*
Database	1.45	1.69*
Statistical	1.44	1.65*
Mathematical	1.56	1.78*
Internet for Info	2.71	2.97*
E-mail with teachers	2.11	2.20

\*Significant difference between means.

The same trend continued in the second year of the computer enrichment with the single difference being that women agreed significantly more to the notion that communicating with professors by electronic mail was generally more gratifying. In all other respects, the women held a more negative attitude toward computers than men or held attitudes similar to the men. This tendency continued with respect of use of computers as well.

The data suggests that the attitude toward computers of women among the laptop students was somewhat less positive than the men in the same group for both the first and second years of computer enrichment. Finally, the data suggests that the general attitude toward computers has become increasingly positive as the computer enrichment progresses and use of computers has increased as well. This finding is a throwback to the earlier days of computing when research had indicated that men were more positively disposed toward computers than women.



Table 3. Year 2 Comparison (Aggregate)

	All Women	All Men
Increased use of technology makes learning easier	3.48	3.25*
I prefer classes in which I get to use computers	3.13	2.75*
I feel comfortable using the computer	4.04	3.66*
I have a certain apprehension about computer use	2.16	2.56*
Computers in teaching makes the learning process too impersonal	2.78	3*
Computer use increases the college work load	2.92	3.01
Computers are effective for communicating with faculty	3.57	3.68
Communicating with professors by e-mail is generally gratifying	3.57	3.74
Computers enable me to interact more with professors	3.41	3.35

\*Significant difference between means.

Table 4. Year 2 Comparison (Aggregate)

Use	All Women	All Men
Spreadsheet	1.95	1.74*
Database	1.74	1.52*
Statistical	1.81	1.76
Mathematical	1.9	1.73*
Internet for Info	3.41	3.13*
E-mail with teachers	2.6	2.61

\*Significant difference between means.

The results from the survey data are both supported and challenged by the findings from the panel study and the qualitative analysis of the reports about computerization that appeared in the camp newspaper and some other institutional publications. The panel study findings indicate that the students with laptops displayed little significant differences in attitudes toward computer and computer use between men and women. Unlike the findings from the entire student body, the members of the panel demonstrated that there was minimal significant differences between men and women. Although this challenges the findings of significant differences in the survey data, it is also the case that the students who participated in the panel study were self-selected on the basis of a presumably higher interest in computers. It has been demonstrated that a positive predisposition toward technology can lead to a more uniform positive attitude toward computers in teaching as well as a higher level of computer use. This finding is also supported

Table 5. Changes in Women Over Time

Item	Year 1	Year 2	Year 3	
Increased use of technology makes learning easier	3.39	3.48	3.63	1=2, 2=3, 1*3
I prefer classes in which I get to use computers	2.72	3.13	3.27	1*2=3
I feel comfortable using the computer	3.38	4.04	4.13	1*2=3
I have a certain apprehension about computer use	3.03	2.16	2.13	1*2=3
Computers in teaching makes the learning process too impersonal	3.25	2.78	2.67	1*2=3
Computer use increases the college work load	3.08	2.92	2.86	1=2=3
Computers are effective for communicating with faculty	3.33	3.57	3.68	1*2=3
Communicating with professors by e-mail is generally gratifying	3.38	3.57	3.65	1=2,2=3, 1*3
Computers enable me to interact more with professors	2.94	3.41	4.19	1*2*3

\*Significant difference between means.

Table 6. Changes in Men Over Time

	Year 1	Year 2	Year 3	
Increased use of technology makes learning easier	3.56	3.25	3.38	1=3, 2=3, 1*2
I prefer classes in which I get to use computers	3.05	2.75	2.77	1*2=3
I feel comfortable using the computer	3.78	3.66	3.9	1=3, 2=3, 1*2
I have a certain apprehension about computer use	2.55	2.56	2.32	1=2=3
Computers in teaching makes the learning process too impersonal	3.07	3	2.77	1=2*3
Computer use increases the college work load	3.06	3.01	3.04	1=2=3
Computers are effective for communicating with faculty	3.31	3.68	3.86	1*2=3
Communicating with professors by e-mail is generally gratifying	3.32	3.74	4.05	1*2*3
Computers enable me to interact more with professors	3.07	3.35	4.32	1*2*3

\*Significant difference between means.

Table 7. First Year of Computer Enrichment, Comparison of Legacy, and Laptop Students

	Legacy Men	Legacy Women	Laptop Men	Laptop Women
Increased use of technology makes learning easier	3.36	3.1*	3.72	3.49
I prefer classes in which I get to use computers	2.98	2.68*	3.42	2.87*
I feel comfortable using the computer	3.97	3.6*	4.17	3.76*
I have a certain apprehension about computer use	2.23	2.57*	2.02	2.54*
Computers in teaching makes the learning process too impersonal	2.94	3.17	2.49	2.72
Computer use increases the college work load	2.92	3.1	2.89	2.86
Computers are effective for communicating with faculty	3.48	3.56	3.75	3.86
Communicating with professors by e-mail is generally gratifying	3.43	3.62	3.84	3.92
Computers enable me to interact more with professors	3.25	3.17	3.73	3.62

\*Significant difference between means.

Table 8. First Year Enrichment Comparison

	Legacy Men	Legacy Women	Laptop Men	Laptop Women
Spreadsheet	2.02	1.75*	1.78	1.7
Database	1.66	1.5	1.89	1.55*
Statistical	1.85	1.81	1.68	1.69
Mathematical	1.8	1.68	2.11	1.82*
Internet for Info	3.35	3.02*	3.52	3.31*
E-mail with teachers	2.5	2.52	2.77	2.76

\*Significant difference between means.

by research in technology diffusion where it has been argued that early adoption of a new technology is not necessarily based on gender. Therefore, the fact that the panel participants report somewhat different attitudes and level of use is not necessarily surprising.

The findings from the analysis of the reports about the computerization process obtained from the descriptive analysis of news stories and editorials, however,

present a somewhat different picture. The onset of the technological process created immediate uproar from the student body from both men and women [30-32]. But such an outcome should be expected when a new policy is cast upon the university and the students have not been allowed a voice until after the plan has begun [29]. As a result of this surprise, gender differences seemed minimal at first and both men and women attacked the process of implementation more than the actual technology itself [33-39]. Both genders were concerned that giving laptops to incoming freshmen would lead to inequality between classes [40-46]. The initial dissatisfaction manifested itself in personal attacks as students seemed to point fingers at classes as a whole. One female student clarified, "Let me go on record as saying I have nothing against the class of 2000, I don't even know them. What I do know is they have been the center of attention at the university way before they even filled out their application" [34].

As the technology enrichments process was further entrenched on campus the differences based on school year began to diminish and the differences between gender began to be more pronounced. Instead of attacking the process of the enrichment method in terms of the lack of student voice, the newspaper article focus moved into actual attacks on technology. The loss of identity as a Liberal Arts institution became the predominant argument against technology. One student writes, "[I hope] the members of the Class of 2000 are here to learn about the Han Dynasty, Redox reactions, and the Milgram experiment, and not how to install Real Audio extensions under Windows 95" (OGB 10/2/96). Students protested, wondering if this was "Wake, Inc." More women championed technology's assault on liberal arts [47, 48]. While men seemed more apt to defend the plan [49], offering potential solutions and urging the good side of technology such as Website usage [30]. Women seemed unpersuaded by the benefits of technology. In fact of three freshmen women interviewed in the 4/25/96 issue, none cited technology as a motivating factor in their deciding to attend Wake Forest.

While the analysis of the student newspaper articles and editorials do not make a particularly strong case for gender differences, as the technology-enrichment process unfolded the data from the newspapers stories lends credence to the statistics gathered through the surveys. The student body originally was unified as it attacked the Plan for the Class of 2000. However, the attack began to change over time as the dissatisfaction fell on the purpose of the technological-enrichment process. And while the newspaper articles do not quantify the amount of negativity exemplified by women, the articles do illustrate a more solid and consistent alliance against technology as women push for liberal arts.

## DISCUSSION

Several different issues begin to emerge from the data reported here. It is, however, first important to acknowledge that the data from the different components of the study do not necessarily support each other. There can be several

different explanations for this limitation and anomaly. It could be the case that the way in which the panel participants were selected had an impact on what they report. Clearly, this is a self-selected group and they might have come into the technology-enriched environment with a different set of expectations and predisposition compared to the general body of students. Therefore, their attitudes and technological behavior might not be truly comparable to the other students. Additionally, the information gleaned through the descriptive analysis could certainly be biased by the specific politics and management of a student-run campus newspaper. This information, is certainly not widely generalizable as the data from a random sample of students responding to a self-report questionnaire.

However, in spite of the possible limitations, and depending largely on the survey component of the study, certain useful conclusions can be drawn. First, it is possible to claim that, like members of many other institutions, the University students had displayed little differences in attitudes toward computers and use of computers prior to the introduction of a complex and elaborate technological-enrichment program. The few significant differences based on gender tended to suggest that the men were more positively predisposed toward computers and tended to use computers more than women. This finding is consistent with previous research on the relationship between gender and computer attitudes. This finding also has to be placed in the context of a liberal arts institution where the thrust of the education was not on skill-development and professional or technical training but on disciplines that traditionally were not highly computer-use intensive. It can be argued that in such environments men and women do not come in with specific expectations and predisposition about computer use. In such environments, the computer remains a "tool" that can be used to advance the learning goals which would not necessarily be learning how to use a computer or how to program a computer, but more on how the computer can make a pedagogic and learning goal more efficiently achieved. We would thus make the argument that when the computer was not the center of attention and publicity for the University, the actual difference in computer use level and attitudes toward computers were minimal, even if statistically significant.

The second major finding follows from the earlier one in logical progression. Once the environment was altered and the overall "ethos" of the University shifted toward a technological orientation, albeit, in enriching the campus only and not in revamping the curriculum to make it a "technical" institution, the expectations about the education that could be obtained from the University could have shifted. Given, the way the University altered its image in the academic marketplace, there was a specific emphasis placed on the computerization process as the University geared up for the new Millennium. Thus, the plan called, "Plan for Year 2000," was publicized as one that would technically enrich the University. Indeed, many other significant aspects of the plan, such as the reduction of class size, and the addition of new faculty sometimes were made less important given the emphasis

that was placed on the technological aspect of the plan. This, as demonstrated in the content analysis, resulted in well-documented displeasure among the legacy students, and that displeasure could have resulted in the extension of some of the more traditional relationships between gender and attitudes toward computers. Thus the women being less favorable toward computers could be based on the fact that the new environment that was perceived to be emerging did not appeal to the women and the blame was placed on technological enrichment and women became more critical of the process than men. There is some evidence that men and women have historically had different attitudes toward technology in general. In a careful historical analysis of the relationship between gender and technology, Pacey made the argument, “women tend to experience technology less as making things and more in terms of the management of process” [50, p. 103]. Although referring more to non-computer technologies, it might address the fundamental issues here in so far as explaining the reversal of attitudes discovered in this study. Once the computer was perceived as the center of the pedagogic activity, women recognized the shift away from the focus from “technology practice” to a focus on the “pure technology” thus rejecting the technology-enrichment process and developing the unfavorable attitudes.

In association with this change, there could have been a third shift in terms of the expectations about the institution. The laptop students also displayed differences between genders with men being more positive toward computers. This phenomenon could be related to two different processes at work in the University. On one hand, the incoming students now had a somewhat different expectation of the environment that they would encounter at the University. While, there was no evidence, particularly in focus groups, that there was any school-choices based on the laptop program the students did enter the environment expecting that computers would play a significant role in their learning process. This expectation, which was different from the traditional perceptions of liberal arts institutions could in itself have led to the fact that women came in greater trepidation than men. Such a conclusion is somewhat congruent with earlier studies about gender and computing where there was some evidence to suggest that men are somewhat more positively predisposed to computing than men. On the other hand, this positive predisposition was also related to the newness of computers, and as other studies have suggested, as the newness disappears and the computer becomes more ubiquitous the gender difference becomes insignificant or switches to a more positive valence for women. In other words, as the computer becomes an expected and standard part of the process of learning, women are likely to embrace it more readily. In many ways, the computer-enrichment phenomenon could be duplicating, in a microcosm, the phenomenon that used to be observed about the relation between gender and computer technology in the past when computers were being introduced into the practice of our everyday life. If that is the case, it can be hypothesized that the differences observed in the first two years of the computer enrichment will begin to disappear with time.

In conclusion it can be claimed that the process of acceptance of computer technology is related to gender where the women are far more cautious about exhibiting a positive attitude than men. However, when the functionality of a technology has been demonstrated within the context of a specific process, in this case the "learning process," women tend to embrace the technology and are often more positively pre-disposed. Furthermore, there are no specific categories of use where this process appears to become more significant, and the differences between men and women with regards to computer use categories is unevenly and somewhat randomly distributed suggesting again that it is the practice of technology that is more critical than the specific technology itself. Pacey made much of this distinction and it appears from this data that women are far more tuned to "technology practice" than the "virtuosity" values of technology.

The distinction between the practice and the virtuosity aspect is particularly evident in the communicative use of the technology. It has been demonstrated in the past that the category of computer use is most rapidly diffused and used is the computer mediated communication aspect of the computer particularly in the realm of e-mail use by teachers and students. It is quite evident in this data that the gender differences among all categories of users disappear in the case of attitudes toward use of computers for communication as well as the actual extent of computer use. This is consistent with the argument that women are as willing as men to apply technology in a particular existing practice, that of communication, when the computer works as a tool to facilitate the process. In this case, the students show no difference by gender and within gender there is a significant increase in the use as well as an increasing positive affect associated with use of the computer for communicating with teachers. The results strengthen the argument that in a broad application of the technology, where its "practice" value is clearly visible the difference between genders disappear, but when the use of the computer, and not the functionality of the use, becomes the focus women remain somewhat more wary of that use.

The prescriptive aspect of these findings is that technology enrichment needs to be accompanied with a clear description of the way in which the technology would be introduced in the primary practice of an institution. In the case of an academic institution this would suggest that there needs to be a clear rationale explicitly stated about the way in which ubiquitous computing would be utilized in the process of teaching. Such explicit definition of the technology practice and its functionality would generate a more positive affect within women, who otherwise would be far more likely to consider the computer enrichment with a greater degree of criticism. Such criticism can then translate to a negative affect eventually creating undesirable gaps between genders. On the other hand, if the expectations and functionality of the technology enrichment is made explicit at the onset, or when in time they become explicit, it can be anticipated that the differences between genders could either disappear or the women could exhibit a more positive pre-disposition than men. All of this suggests that planners of technology

enrichment need to be sensitive of the gender of the users and consequently make adopt specific planning strategies to ensure that unwanted gender-based rifts do not result from the process of technology enrichment.

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Direct reprint requests to:

Ananda Mitra  
 Department of Communication  
 Wake Forest University  
 Box 7347 Reynolda Station  
 Winston-Salem, NC 27109